

Mezzanine Selection Guide: 9 Key Steps

Introduction

Adding more space to an existing building is an important decision for even the most experienced building owner or facility manager. New construction or building modifications are two common solutions, but structural steel mezzanines offer a third alternative at potentially less cost and in less time.

This paper is designed to help building owners and facility managers to determine if a mezzanine is appropriate for their specific need, and to cover the primary considerations that must be addressed in selecting and designing the best mezzanine solution for that need.

Nine primary mezzanine project management steps will be covered:

1. Establish the application requirements
2. Evaluate the structural and floor layout characteristics of the building
3. Governing body compliance: building codes, professional engineer stamps and seismic requirements
4. Evaluate the most common construction types/methods
5. Select a mezzanine design style
6. Select the deck surface
7. Select the paint color and finish
8. Structural options
9. Choose a mezzanine manufacturer

What Is a Mezzanine?

A mezzanine is a steel structure that adds a second or third floor level inside a facility and thereby doubles or triples the existing space. Generally speaking, a mezzanine consists of steel support columns, steel framing, decking, hardware and accessories/options such as stairs, platforms, guardrail, handrail and safety access gates.

Mezzanines Solve a Variety of Space Problems.

Mezzanines can be installed inside manufacturing and processing plants, retail stores, office buildings, industrial plants, warehouses, distribution centers, institutions, schools and universities, government facilities and more. Typically, whenever a business wishes to expand their floor space and has the overhead volume within their existing facility, a mezzanine can provide an economical and flexible alternative.

Nine Key Steps

STEP 1: Establish the application requirements

A thorough analysis of the current and future uses of the mezzanine will help determine if it is a viable option for a specific application. If a mezzanine is deemed appropriate, the initial analysis will also help to establish some of the structural characteristics for the most appropriate design.

Some of the main things to consider include:

What will be stored on the mezzanine?

Determine if the mezzanine will be used to support equipment and/or store bulk materials, equipment, company records, parts, small packages, etc. Also, decide if the mezzanine will support in-plant offices, shelving, carousels, workstations or other material handling products. The size, weight, and concentrated loading of all items stored on the mezzanine will impact the overall design.

What are the safety issues and future expansion needs?

Will employees and/or customers and other visitors be accessing the mezzanine? If so, list all potential safety features you may need (stairs, handrail, gates, guardrails, kick plates, safety loading gates). Also take future company growth or expansion plans into consideration. If a company is planning to relocate in the near future, a mezzanine that can be disassembled and moved to a new facility may be preferred. It is important to address this during initial mezzanine design stages.

STEP 2: Evaluate the structural and floor layout characteristics of the building

Study the facility floor plan.

A comprehensive diagram should be completed detailing what is currently located on the floor. Can certain operations, equipment or materials be moved or relocated to accommodate the mezzanine? Determine whether the mezzanine will be tied into an existing production line or assembly process. Make notes on other obstructions that might impact the mezzanine design or configuration (e.g. building walls, doorways, cranes, building columns, existing equipment, electrical panels, etc.).

Determine an acceptable mezzanine column layout

The mezzanine column layout, which includes column spans and column configuration, is especially important if a mezzanine will be built over an existing production line, traffic areas, equipment, or work areas. The design of the mezzanine will be impacted by the number of support columns that can be located on the floor, the placement, and whether or not they can be integrated with the floor plan and current operations.

Wide span designs require fewer mezzanine support columns, which may be important if the current floor plan is congested and/or space is extremely tight. However, fewer columns mean higher loads per column, increasing the likelihood that concrete footings will be needed (see floor slab section below). General physics also dictates that middle columns take on more load than perimeter columns.

Mezzanine Advantages

- Offset rising space costs.
- Save new construction costs.
- Eliminate leased space.
- Affordable solution that utilizes existing “cube”.
- Easy to disassemble and relocate.
- Save insurance premiums & property taxes.
- Reduce building maintenance.
- Qualify for accelerated tax depreciation.
- Double or triple your existing space.
- Save land acquisition and energy costs.
- Improve inventory management & control.
- Customized to fit your exact space needs.
- Expandable to meet future growth needs.
- Streamline logistics & improve communication.

Framing Material Examples for Various Spans	
<p>Cold-Formed C Channel Construction</p>  <p>Short Span: Less than 40ft between columns</p>	<p>Bar Joist Construction</p>  <p>Wide Span: 40ft or more between columns</p>

Reputable mezzanine companies will design a column layout that will best fit the current floor plan and application needs, balancing the desired characteristics of the mezzanine with the physical limitations of the building. The key is to provide an economical solution to the customer by using the appropriate amount of steel to support the necessary load.

Verify Existing Foundation

Since a mezzanine is typically built on top of an existing floor, it needs to be determined if the floor slab is strong enough to support the structure. The four critical characteristics used to determine slab strength are:

- Slab thickness
- Concrete strength (typically measured in psi)
- Quantity and size of steel reinforcement (rebar)
- Soil bearing capacity (typically measured in psf)

The original building construction drawings, (specifically foundation drawings) should outline the existing slab and soil conditions. If not, contact a geotechnical firm to take core samples and analyze the slab and soil bearing strength.

NOTE: Floor slab and soil conditions greatly affect mezzanine design and column loads - so it is critical to determine if the slab will provide the necessary support. Reputable mezzanine manufacturers will conduct a floor slab analysis prior to designing the mezzanine.

For an average 6" slab, a footing might be required if a column's load is greater than 25,000 lbs. If the floor slab is less than average than footings may be needed at lesser column loads. Footings distribute the weight placed on a column throughout a larger area to keep the column from damaging the slab.

Verify Environmental Conditions

Will the mezzanine be exposed to extreme or harsh conditions? Environmental conditions (heat, water, humidity, exterior weather) play a role in determining what structural materials and finishes should be used on the mezzanine.

Example: Mezzanines exposed to regular washdown operations (i.e.: food processing, pharmaceutical, chemical facilities) may incorporate stainless steel, galvanized or fiberglass components.

STEP 3: Governing body compliance: building codes, professional engineer stamps and seismic requirements

There are important codes, guidelines and best practices that must be followed to assure that any mezzanine is safe, structurally sound, and appropriate for the building, application, and geographic location in which it is installed. A reputable mezzanine builder will comply with all building codes, while assuring that the structure is not overbuilt for its intended purpose and location, and that an economical structure is provided.

Building Codes

The International Building Code (IBC) is the primary building code adopted throughout the United States for both new construction and renovations to existing buildings. Occupational Safety and Health Administration (OSHA) requirements will also apply to mezzanine construction in operating facilities. If a permit is not required, local code compliance is still the responsibility of the facility owner, and additional codes may also apply depending on the state in which the mezzanine will be constructed. California, for example, has codes for mezzanines that go beyond those outlined by the IBC. Consult the local building inspector and a qualified mezzanine builder for guidance on designing a mezzanine that meets your specific code requirements.

For more info on the IBC and the ICC speak with a mezzanine builder or visit www.iccsafe.org.

Material Standards

Additionally, all materials and hardware used to build a mezzanine should meet standards as defined by ASTM, AISC, and AISI. Materials and manufacturing methods used to fabricate support columns, base plates, structural framing, joists, roof deck and handrails are critical to the safety and structural integrity of a mezzanine system, and as such, should conform to these national standards.

PE Stamped Custom Mezzanines

A Professional Engineer (PE) is an engineer certified and licensed by a State Board of Registration to practice engineering within that state. The PE license is the engineering profession's highest standard of competence, a symbol of achievement and assurance of quality. In order to become a PE, an engineer must go through rigorous testing, in addition to earning an ABET-accredited engineering degree and working as an engineer-in-training for a minimum number of years as determined by each state.

A professionally engineered mezzanine stamped and sealed by the PE of record will ensure a structurally sound design. To secure a building permit for mezzanine systems, all drawings and calculations must be stamped by a Professional Engineer licensed within that state.

Having a Professional Engineer stamp the drawings and calculations for a mezzanine is no small matter. Once a PE stamps a drawing he or she becomes personally liable should the structure fail due to faulty design.

Seismic Requirements

While our entire planet is seismically active, there are particular areas in the world that are more susceptible to earthquakes of higher magnitude than others. The states along the US west coast have high seismic activity, but there are also other areas within the US that are seismically active, such as the New Madrid in the Midwest, as well as areas in South Carolina and in some northeastern states.

Determining the likelihood and magnitude of earthquakes where a mezzanine is to be installed is critical to proper design. In the past, the accepted seismic design method used by the IBC was "Seismic Design Zones" with an alphabetical designation of A, B, C, D, E, or F. Currently, the IBC recognizes "Spectral Response Acceleration" factors as a determining element for properly designing structures within various seismic regions. This newer system recognizes and quantifies many more "zones" than the older system, and is a more refined system to each specific location.

STEP 4: Evaluate the most common construction types/methods

There are three common construction types for structural mezzanines, each with their own benefits and applications for which they are suited.

Conventional Construction ("Stick Built")

A conventionally-constructed platform, or "stick-built" platform, is typically designed by an independent engineer, and then built separately by a local contractor at the jobsite. With a stick-built platform, most of the material storage and fabrication activities (e.g., cutting, grinding, welding, assembling) take place directly on the floor at the jobsite. This can be the most custom of all options, as many times dimensions and material fabrication are field-engineered to the existing space and the desired application. Because of the complexity of designing a mezzanine, stick-built structures are often the simplest with fewer features and options.

Custom Manufacturing

Custom mezzanines are pre-engineered and pre-manufactured in a shop environment. They are designed to fit around existing plant equipment, building columns, and other obstructions, and are designed for the specific loading and capacities as needed by the user. The pre-manufactured materials are shipped to the jobsite where they can be assembled using special fasteners and hardware in a short period of time. Custom manufactured mezzanines can incorporate short or wide spans, unique column spacing, and special cantilevering. Custom mezzanines are often integrated with conveyors, vertical lifts, rack, in-plant offices, shelving systems, and other material handling products to help maximize existing cube as well as improve product flow. Single or multi-level mezzanines are available to meet the exact

Common Mezzanine Applications

- Production equipment
- Distribution centers
- Offices
- Storage
- Assembly space
- Parts departments
- Stockrooms
- Company records storage
- Work platforms
- Retail showroom
- Trade show exhibit
- Equipment support
- Cafeterias
- Locker rooms

area, height, color, and load requirements of the application. Custom mezzanines offer unlimited design options, features, and variations, and are able to meet application requirements from the very simple to the highly complex.

Modular Manufacturing

Modular mezzanines are prefabricated and sold in standard sizes or modules (e.g., 10ftx10ft or 15ftx15ft). In essence, the end user purchases packaged components with predetermined dimensions and specifications. Modular mezzanines do not always fit the exact area or application load requirements. A module typically includes column uprights, framing, and a deck surface. Stairs, railing, gates, kick plate and other components are usually considered options or additions. Modular mezzanines are typically installed by the end user or a local contractor.

Construction Type	Advantages	Disadvantages
Conventional Construction	<ul style="list-style-type: none"> • Potentially a quicker solution • Potentially less material shipping costs • Can be made to match existing building materials • Hiring of local labor 	<ul style="list-style-type: none"> • Quality is unknown until project is finished • Often uses more materials than necessary • Often not very cost effective • Difficult to get accurate schedule estimates • Disruption to existing operations
Custom Manufacturing	<ul style="list-style-type: none"> • Customized to fit exact area, height and load capacities • Very little management – supplier provides turnkey solution • Complies to all building codes • Designed to fit around existing equipment, building columns and other obstructions • Can be specifically engineered for Seismic Zones • Predictable delivery / installation times 	<ul style="list-style-type: none"> • Materials have to be shipped in, freight cost • Field measurements required for custom fit
Modular Manufacturing	<ul style="list-style-type: none"> • Predictable delivery and installation times • Potentially less expensive than other options 	<ul style="list-style-type: none"> • Not suited to custom space • Materials have to be shipped in, freight cost

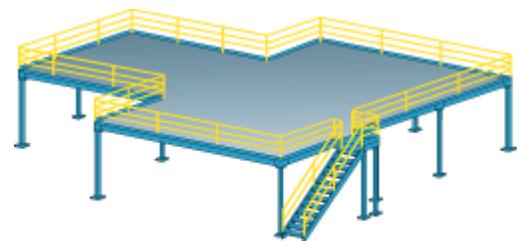
STEP 5: Select a mezzanine design style

Mezzanines are available in a variety of design styles, most of which can be built by any of the construction types outlined in Step 4. Depending on the application and the characteristics of the available space in the existing building, the most appropriate design is likely to be identifiable before meeting with a mezzanine manufacturer. There are two basic design styles, each with several variations.

Freestanding Mezzanines

Supported by columns rather than existing structures or racks, freestanding mezzanines provide the maximum use of floor space below the mezzanine and full space utilization on the mezzanine level. Freestanding mezzanines are available with column spans up to 40 feet and more.

Mezzanine framing designs can allow lighting, sprinkler pipe, computer and electrical conduit, and HVAC ductwork to easily pass under or through the mezzanine structural framework, eliminating overhead obstructions and increasing usable space on



Freestanding

the ground floor. Mezzanine framing can also be cantilevered to allow for a custom fit around building columns, conduit, ductwork and other obstructions.

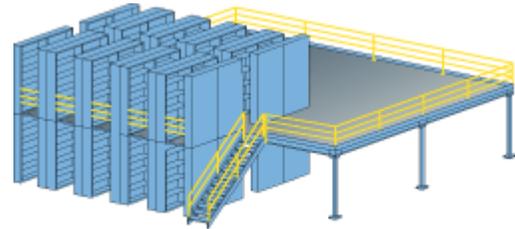
Freestanding mezzanines offer the most flexibility in the event of an equipment layout change, as compared to a rack or shelving supported mezzanine in which the whole system would need to change.

Shelving/Rack Supported Mezzanines

Shelving or Rack supported mezzanines are either fully or partially supported by shelves or racks. The racks and shelves that support the mezzanine are typically close together. There are two common variations of shelving/rack supported mezzanines:

Catwalk

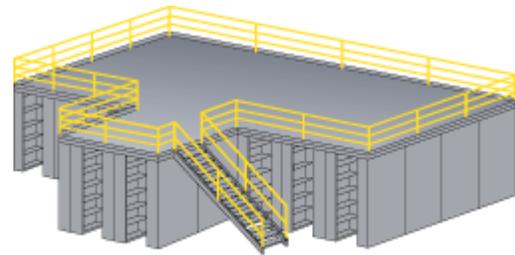
Catwalk mezzanines are ideal for increasing the capacity of tall shelving or rack storage areas, allowing the upper areas of the racks to be accessed from catwalks extending from the mezzanine floor. In many cases, existing shelving uprights provide adequate support for the mezzanine frame. Where needed support columns can be used to provide additional support, both between shelves and under areas of the mezzanine that are free of racks or shelves.



Catwalk

Full Mat

Full Mat mezzanines combine features of both freestanding and catwalk styles, and are typically supported by existing shelving or rack uprights that do not extend above the mezzanine floor. The second level is open area and can be used for bulk storage, office space, employee cafeterias and a number of other applications. Full mat mezzanines can be installed over existing shelving or rack uprights.



Full Mat

STEP 6: Select the deck surface

Mezzanines are available with a variety of flooring material.

Corrugated steel roof deck is commonly used as the primary mezzanine deck. Once installed (as part of the mezzanine), steel roof deck can then be covered with a number of floor surfaces. For example:

Steel Roof Deck with High Density Wood

- Economical
- Can support pallet jack loads up to 4,500 lbs
- Comfortable to walk on
- Easy to install
- Good for storage mezzanines, offices and production lines



Steel Roof Deck with Concrete Floor

- Noncombustible and easy to clean
- Permanent structure that is poured in place
- One of the more expensive flooring options
- Good for heavy manufacturing and extremely wet wash down areas
- Provides both a fire and sound resistance



areas

Steel Roof Deck with Steel Floor Plate

- Extremely durable and fire resistant
- Common applications are in metal forming foundries and chemical environments



Steel Roof Deck with Plywood Floor

- Economical
- Good for situations such as foot and light cart traffic, and as an underlayment for carpeting or tile in offices

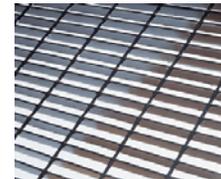


There are also other custom deck surfaces available that can be used with mezzanine systems, such as fiberglass, grating and aluminum plate.

Other types of deck systems can be applied directly over the mezzanine framing (without corrugated roof deck). For example:

Heavy-Duty Steel Bar Grating

- For applications where light and airflow are important
- Typical bar grating is 82% open to provide air circulation and lighting below the mezzanine



Steel Floor Plate

- Extremely durable and fire resistant
- Common in the food and beverage industry where plants require sanitary conditions



strict

STEP 7: Select the paint color and finish

Paint Colors and Finishes

A variety of paint colors and paint finishes are commonly available through leading mezzanine manufacturers. There are three main types of paint processes:

Powder Coat

Powder coated finishes are extremely durable and attractive. Powder coating is commonly used in industrial applications such as mezzanines, as well as commercial applications and even consumer-based commercial applications such as exercise equipment and even many automobiles. Powder coat paints are available in a variety of colors, and custom colors can be created to match exact requirements, allowing a mezzanine to be color matched with corporate schemes or existing structures (storage rack, shelving, conveyors, carousels, etc.). Powder coating is also available in various resin types, including urethanes, polyesters, epoxies, and hybrid combinations. Powder coat paints also do not emit VOC's when applied, making them more environmentally friendly than solvent-based alternatives.

Wet Spray

Wet spray, or solvent-based paints are a basic choice when it comes to industrial finishes. Wet spraying is ideal for items which cannot tolerate the high temperatures involved in the powder coating process. Items suited to wet spraying include plastics, fiberglass, and electronics. Like powder coating, wet spraying can provide a durable and attractive finish with a wide range of color options to choose from.

Galvanized

A Galvanized finish bonds with the metal surface where powder coating and wet spray finishes coat the surface. Galvanized is a dipped finish which guarantees 100% coverage. It is the best finish for chemically harsh environments, exterior applications, or applications that involve frequent wash down operations. It is the most expensive of the three processes.

STEP 8: Structural options

Mezzanines can be equipped with a variety of features and options. Some options might be absolutely necessary (stairs and handrails) while others are application driven. Common options to consider include:

Handrails. Depending on the manufacturer, there are a variety of handrail styles to choose from: vertical or horizontal railing, cable, expanded metal and other options. Keep in mind, building code compliance is extremely important to consider with handrails.

Mezzanine Access Gates. Swing, sliding, and pivot safety gates are among the most common options. Gates help you safely move materials by providing convenient access to mezzanines and other elevated storage areas within your facility.

Stairways, Landings & Platforms. Stairs are available in a variety of widths and custom configurations. Stairs should be professionally engineered to meet IBC, UBC or OSHA requirements.

Ancillary Products. Custom mezzanines can be integrated with other material handling products such as shelving, rack, carousels, flow rack, in-plant offices, VRCs, powered conveyors; whatever is needed to help maximize plant cube as well as improve product flow.

STEP 9: Choose a Mezzanine Manufacturer

To select a mezzanine company, it is important to fully research and evaluate their experience, past success, engineering expertise and manufacturing quality. A custom mezzanine company will handle all project details, from fully assessing the complete application needs, taking on-site measurements, and designing the most appropriate mezzanine, to adhering to all necessary codes, the fabrication or parts and materials, and final installation.

Evaluate experience

The following criteria are important questions to ask when evaluating the experience of a mezzanine manufacturer:

- How many mezzanines has the company installed?
- What size mezzanines have they built (100sqft, 1,000sqft, over 100,000sqft)?
- Have they serviced other companies in your industry?
- Is a references list from past customers available?
- Does the manufacturer offer PE stamps for your state?
- Do they have other mezzanines in your area?

Does the mezzanine company provide design, fabrication, and installation services?

Mezzanine installation should be conducted per the drawings and manuals provided by the manufacturer. Ideally, installation should be performed by factory-trained or supervised personnel. If a building owner chooses to handle the installation, determine if the mezzanine manufacturer will provide factory supervision.

Does the mezzanine have a warranty?

If so, what is the term and what is covered? At the very least, the mezzanine manufacturer should cover all structural components of the mezzanine. A warranty is a statement of quality. If the company doesn't offer one, look elsewhere.

Choose a Quality Mezzanine Company

- Proven experience
- Extensive customer list
- Variety of installations & sizes
- Active in professional associations
- On-staff, licensed professional engineers
- Licensed fabrication facility
- Mezzanine materials meet ASTM and AISC specifications
- Nationwide dealer network for service
- Warranties

This whitepaper has been authored by Cubic Designs, a leading manufacturer of custom, pre-engineered mezzanine systems for a wide variety of industrial, warehouse and retail applications.

For more information please call 800-826-7061 or visit www.cubicdesigns.com